UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/559,944	12/08/2005	Yong-Ku Baek	MAC-10865	1504

23123 7590 04/13/2011

SCHMEISER OLSEN & WATTS
18 E UNIVERSITY DRIVE
SUITE # 101
MESA, AZ 85201

EXAMINER	
CHANDRA, SATISH	
ART UNIT	PAPER NUMBER
1716	
MAIL DATE	DELIVERY MODE
04/13/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/559,944	BAEK ET AL.	
	Examiner	Art Unit	
	SATISH CHANDRA	1716	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11/2/2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 – 3, 5 – 15 and 18 – 22* is/are pending in the application.

4a) Of the above claim(s) *7, 16, 17, 23 - 29* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 – 3, 5, 6, 8 – 15 and 18 – 22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 December 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *4/21/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/2/2010 has been entered.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 amendment recites ' wherein an upper space of the susceptor is divided by a plurality of partition Walls'.

It is not clear to the Examiner what is divided by a plurality of partition walls? Is it the susceptor itself comprising a plurality of partition walls, or is it the space between the gas distribution means and the susceptor comprising a plurality of partition walls or is it the gas distribution means comprising a plurality of partition walls?

For the purpose of examination, the Examiner will interpret it as the gas distribution means comprising a plurality of partition walls.

Claim Rejections - 35 USC § 112/ 6th rejection

It is noted that the claim language of claim 1 has invoked 35 USC 112, sixth paragraph since the applicant's disclosure does not disclose 'means for' exhausting gases from the chamber. The written description fails to disclose the corresponding structure, material, or acts for the claimed function.

Similarly this claim recites several other means for functions such as rotation driving means, a gas distribution means for distributing and spraying the gases, a gas supply means for supplying a plurality of gases to the inside of the reaction chamber.

Applicant is required to:

(a) Amend the claim so that the claim limitation will no longer be a means (or step) plus function limitation under 35 U.S.C. 112, sixth paragraph; or

(b) Amend the written description of the specification such that it expressly recites what structure, material, or acts perform the claimed function without introducing any new matter (35 U.S.C. 132(a)).

If applicant is of the opinion that the written description of the specification already implicitly or inherently discloses the corresponding structure, material, or acts so that one of ordinary skill in the art would recognize what structure, material, or acts perform the claimed function, applicant is required to clarify the record either:

(a) Amending the written description of the specification such that it expressly recites the corresponding structure, material, or acts for performing the claimed function and clearly links or associates the structure, material, or acts to the claimed function, without introducing any new matter (35 U.S.C. 132(a)); or

(b) Stating on the record what the corresponding structure, material, or acts, which are implicitly or inherently set forth in the written description of the specification, perform the claimed function. For more information, see 37 CFR 1.75(d) and MPEP 2181 and 608.01(o).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3, 5, 6, 8, 11 - 13, 15 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171) and Hwang et al (US 6,656,284).

Shim discloses: regarding claim 1, an atomic layer deposition apparatus having a reaction chamber for forming a thin film on a plurality of substrates 160 rested on a susceptor 151 (Fig 3, whole disclosure), the apparatus comprising: a gas supply means 100 for supplying a plurality of gases (abstract) to the inside of the reaction chamber from the outside, the gases including a reaction gas; a gas distribution means for distributing and spraying the gases supplied from the gas supply means so as to conform to the purpose of a process; a gas retaining means 131 – 134 (Figs 5 – 8) having a plurality of reaction cells 131 - 134 for partitionally accommodating and

retaining the respective gases distributed from the gas distribution means; **a rotation driving means 170 for rotating selectively the susceptor** such that the gases retained in the respective reaction cells are exposed to the substrates in sequence; and a gas exhaust means 154 for pumping the gases retained by the gas retaining means to the outside of the reaction chamber. Shim discloses that invention relates to ALD equipment in which a thin layer is formed proportionally to the number of reaction cycle by the surface concentration of each reactant injected on the substrate surface. After one reactive gas is chemically absorbed, the second or the third gas comes in and a thin layer is formed on the substrate while the chemical absorption again occurs. The gases are alternately supplied on the substrate surface. **Shim discloses in Para 64, the injection grooves 131a- 133c formed on each injector 131 – 134 provides the space in which the gas coming in spreads. This reduces the fast speed of the inflow gas**. It is inherent that these injection grooves function has gas retaining means as recited in the claim language of claim 1.

Shim does not disclose: regarding claim 1, wherein an upper space of the susceptor is divided by a plurality of partition Walls so as to increasingly broaden the width of the reaction cells from the inside to the outside of the gas retaining means for partitionally accommodating.

Benko discloses: regarding claim 1, discloses a slotted injection plate comprising slots 22 extending radially of non – uniform width so as to compensate for a non-uniform rate of deposition (Figs 2, 3, abstract). Applicant please note, these slots increasingly broaden from inside to the outside of their aperture. Benko discloses the

purpose of these slots is to combat a tendency for the gas precursors to deposit more thickly on the center of the substrate 17 than at the substrate periphery (Column 4, lines 5 – 10).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the retention cells for retaining gas of Shim to increasingly broaden the width of the reaction cells from the inside to the outside in the apparatus of Shim as taught by Benko.

The motivation for modifying the retention cells for retaining gas of Shim to increasingly broaden the width of the reaction cells from the inside to the outside in the apparatus of Shim is to combat a tendency for the gas precursors to deposit more thickly on the center of the substrate than at the substrate periphery as taught by Benko.

Shim and Benko do not disclose: regarding claim 1, concurrently retaining the respective gases distributed from the gas distribution means.

Shin discloses: regarding claim 1, in Para 0038, a processing apparatus wherein all the necessary gases are simultaneously and continuously supplied thus preventing time delay due to valve manipulation and the variation in flow rates of the gases, increasing the speed of an ALD process, improving the stability of the ALD process, minimizing the on/off manipulation of the plasma generator, and preventing damage to the apparatus and the quality deterioration of an obtained thin film.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to supply all the necessary gases are simultaneously and continuously in the apparatus of Shim and Benko as taught by Shin.

The motivation for supplying all the necessary gases are simultaneously and continuously in the apparatus of Shim and Benko is to prevent time delay due to valve manipulation and the variation in flow rates of the gases, increasing the speed of an ALD process and improving the stability of the ALD process in their apparatus as taught by Shin.

Shim, Benko and Shin do not disclose: regarding claim 1, supplying various gases in their apparatus.

Hwang discloses: regarding claim 1, a rotational gas injector (Fig 7) supplying a plurality of gases (Column 4, lines 45 – 57) may be different, and a part of them may be the same.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to supply a plurality of gases which may be same or different in the apparatus of Shim, Benko and Shin as taught by Hwang.

The motivation for supplying a plurality of gases which may be same or different in the apparatus of Shim, Benko and Shin is to supply the desired same or different gases for forming a thin film in their apparatus as taught by Hwang.

Regarding claim 3, Shim discloses: the gas supply means 100 supplies at least two or more reaction gases and a purge gas (abstract, Para 21, 94). Further it has been held the mere duplication of parts has no patentable significance unless a new

and unexpected result is produced. In re Harza, 274 F.2d 669, 124 USPQ 378 (CCPA 1960).

Regarding claim 5, a gas supply means 100 (Fig 3) comprising an upper panel 110 and a plurality of reaction cells 132 - 134 partitioned in there. It is inherent that the upper panel comprises an upper plate.

Regarding claim 6, Shim discloses: an octagonal shaped upper gas panel 110 (Fig 6) wherein the partition walls are installed in radial direction (the boundary section of the injection grooves 312 – 134 in Fig 6).

Shim does not disclose: regarding claim 6, a circular gas panel.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a circular gas panel in the apparatus of Shim et al.

The motivation for providing a circular gas panel in the apparatus of Shim et al is to provide an alternate and equivalent shape of the upper gas panel in the apparatus of Shim et al. Further it has been held in *re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966)* that the shape was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular shape was significant. (Also see MPEP 2144.04(d)).

Regarding claim 8, Shim discloses: the injection grooves (reaction cells) in Figs 6 and 7 are disposed in the upper gas panel comprising an outer peripheral wall (not labeled) connecting the end portions of the partition walls.

Regarding claim 11, Shim discloses: the speed of rotation of the susceptor 151 in which the wafer 160 is settled in the top is desirable in the range of 5 rpm to 200 rpm.

Regarding claim 12, Shim discloses: the gas distribution means includes; a fixing means 133e (Fig 7) for fixing the gas retaining means 131a ; a distribution main body 135 (Fig 5) inserted into the central portion of the upper plate and closely contacting the respective partition walls; a gas inlet ports formed (not shown) in the distribution main body such that gases supplied from the gas supply means are individually introduced; a distribution chamber fluid-communicated with the gas inlet ports and having a desired space formed therein for partitionally accommodating the respective gases; and a plurality of lateral spray ports (not disclosed) formed in the later face of the distribution main body such that the gases accommodated in the distribution chamber are sprayed to the lateral faces of the respective reaction cells.

Regarding claim 13, Shim discloses: the purge gas is further provided with a downward spray port 133c (Fig 8b). Further supply an inert gas to any of the grooves is the intended use of the apparatus and the apparatus of Shim is capable of supplying an inert gas to any of the grooves, including through the downward spray port 133c.

Regarding claim 15, Shim discloses: the distribution chambers (reaction cells) to which the gases are supplied, are fluid communicated with each in their distribution chamber.

Regarding claim 21, Shim discloses: a remote plasma generator (not shown) is connected to the gas supply area for generating radicals (Para 55, 99).

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171) and Hwang et al (US 6,656,284) as applied to claims 1, 3, 5, 6, 8, 11 - 13, 15 and 21 above and further in view of Kido et al (US 2003/0041971).

Shim, Benko, Shin and Hwang were discussed above and disclose the gas retaining means is connected at its central portion with the lower end of the gas distribution means.

Shim, Benko, Shin and Hwang do not disclose: regarding claim 2, the reaction cell being integrally rotated together with the gas distribution means.

Kido discloses: regarding claim 2, in Para 0248, 0249, both the lifting stage (could be viewed as applicant's reaction cell) and the gas spouting plate (gas distribution means) are rotated together mutually to spray process gas uniformly.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to rotate both the gas distribution means and the reaction cells together in the apparatus of Shim, Benko, Shin and Hwang as taught by Kido.

The motivation for rotating both the gas distribution means and the reaction cells together in the apparatus of Shim, Benko, Shin and Hwang is to optimize their apparatus for spraying the process gas uniformly as taught by Kido.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171) and Hwang et al (US 6,656,284) as applied

to claims 1, 3, 5, 6, 8, 11 - 13, 15 and 21 above and further in view of Horie et al (US 6,132,512).

Shim, Benko, Shin and Hwang do not disclose: regarding claim 9, the partition wall is further provided at both the lower end sides thereof an extension plate extending in parallel to the susceptor so that the gas mixing between the neighboring reaction cells is prevented.

Horie et al discloses: regarding claim 9, in Figs 4 and 5, guide plates 12 extending downwardly for preventing the gases from leaking laterally are attached to the respective opposite side edges of the lower panel of the gas ejection head 10.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide guide plates extending in parallel to the susceptor for preventing the gases from leaking laterally in the apparatus of Shim, Benko, Shin and Hwang as taught by Horie et al.

The motivation for providing the guide plates extending from the reaction cell partition walls is to prevent the gases from leaking laterally (preventing the gases from mixing) in the apparatus of Shim, Benko, Shin and Hwang as taught by Horie.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171), Hwang et al (US 6,656,284) and Horie et al (US 6,132,512) as applied to claim 9 above and further in view of Tei et al (US 6,929,830).

Shim, Benko, Shin, Hwang and Horie do not disclose: regarding claim 10, the spacing between the extension plate and the substrate is maintained below 3 mm while not contacting each other.

Tei et al discloses: a plasma processing apparatus wherein the gap Tg between the showerhead surface and the upper surface of the substrate is less than 10 mm (more specifically less than 50 mm and much less than 10 mm), any reaction by-products produced in the space A can be quickly removed with exhaust gas so that the formed film will be practically free from pin holes and hence of high quality.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a spacing between the extension plate and the substrate is less than 10 mm in the apparatus of Shim, Benko, Shin, Hwang and Horie as taught by Tei..

The motivation for providing a spacing between the extension plate and the substrate is less than 10 mm in the apparatus of Shim, Benko, Shin, Hwang and Horie is to optimize the spacing between the extension plate and the substrate surface for providing a smaller space for confining and removing the gases from the space in their apparatus.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171), Hwang et al (US 6,656,284) and Horie et al (US 6,132,512) as applied to claim 9 above and further in view of Ahn et al (US 2006/0000412).

Shim, Benko, Shin, Hwang and Horie do not disclose: regarding claim 10, the spacing between the extension plate and the substrate is maintained below 3 mm while not contacting each other.

Ahn discloses: a processing apparatus wherein the distribution plate comprises projection wall 134 (wall extension) extending vertically downward from the distribution plate (fig 1). Ahn further discloses in Para 0041 the inner chamber is smaller in volume than chamber 100 and thus requires less gas and less fill time to achieve desired chemical concentrations (assuming all other factors equal.) More precisely, the exemplary embodiment provides an inner chamber with an empty volume in the range of 70 to 350 cubic centimeters, based on a 1-to-5 millimeter inner-chamber height and a fixture with a 30-centimeter diameter. Additionally, the number and arrangement of holes in the fixture as well as the placement of the holes close to the substrate, for example within five millimeters of the substrate, promote normal gas incidence and uniform distribution of gases over the targeted portion of substrate 200.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the spacing between the extension plate and the substrate is maintained between 1 – 5 mm while not contacting each other in the apparatus of Shim, Benko, Shin, Hwang and Horie as disclosed by Ahn et al.

The motivation for providing the spacing between the extension plate and the substrate is maintained between 1 – 5 mm while not contacting each other in the apparatus of Shim, Benko, Shin, Hwang and Horie is to provide uniform gas distribution to promote normal gas incidence in their apparatus as disclosed by Ahn et al.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171) and Hwang et al (US 6,656,284) as applied to claims 1, 3, 5, 6, 8, 11 - 13, 15 and 21 above and further in view of Watanabe et al (US 2005/0017100).

Shim, Benko, Shin and Hwang do not disclose: regarding claim 14, the fixing means include a plurality of connection grooves formed in the distribution main body and a connection protrusion formed in on end portion of the respective partition walls so as to be inserted and connected into the connection groove.

Watanabe discloses: regarding claim 14, a nozzle plate member for supplying fluids in dispersed manner comprising a peripheral protrusion 13 (Fig 2, Para 0082) and a groove 25 to provide a secured sealing between the plates to prevent the leakage of the fluids.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a fixing means comprising a protrusion and a groove for providing a connection between plates in the apparatus of Shim, Benko, Shin and Hwang as taught by Watanabe.

The motivation for providing a fixing means comprising a protrusion and a groove for providing a connection between plates in the apparatus of Shim, Benko, Shin and Hwang is to provide an alternate and equivalent fixing means in their apparatus as taught by Watanabe.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171) and Hwang et al (US 6,656,284) as applied to claims 1, 3, 5, 6, 8, 11 - 13, 15 and 21 above and further in view of Okase (US 5,884,009).

Shim, Benko, Shin and Hwang not disclose: regarding claim 18, a restriction plate is installed in such a way as to be protruded along the inner peripheral face of the reaction chamber so as to be closely contacted with the upper periphery of the susceptor when it ascends, and the gas exhaust means is installed such that gas in a space between the inner peripheral face of the upper space of the reaction chamber and the outer periphery of the reaction cell can be pumped through an exhaust port, the reaction chamber being restricted by the ascending susceptor.

Okase discloses: regarding claim 18, a wafer support table 130 (Fig 9) is supported for vertical movement in the vessel 100. Vertical cylindrical walls 131 are formed in a peripheral part of the wafer support table 130 so as to overlap the cylindrical walls 122 (restriction plate) of the gas diffusing plate 120 when the wafer support table 130 is raised to a processing position.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a restriction plate, installed in such a way as to be protruded along the inner peripheral face of the reaction chamber so as to be closely contacted with the upper periphery of the susceptor when it ascends, and the gas exhaust means is installed such that gas in a space between the inner peripheral face

of the upper space of the reaction chamber and the outer periphery of the reaction cell can be pumped through an exhaust port, the reaction chamber being restricted by the ascending susceptor in the apparatus of Shim, Benko, Shin and Hwang as taught by Okase.

The motivation for providing a restriction plate, installed in such a way as to be protruded along the inner peripheral face of the reaction chamber so as to be closely contacted with the upper periphery of the susceptor when it ascends, and the gas exhaust means is installed such that gas in a space between the inner peripheral face of the upper space of the reaction chamber and the outer periphery of the reaction cell can be pumped through an exhaust port, the reaction chamber being restricted by the ascending susceptor is to optimize the apparatus of Shim, Benko, Shin and Hwang to provide a small confine space in their apparatus for carrying out a reaction as taught by Okase.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171) and Hwang et al (US 6,656,284) as applied to claims 1, 3, 5, 6, 8, 11 - 13, 15 and 21 above and further in view of Ahn et al (US 2006/0000412).

Shim, Benko, Shin and Hwang do not disclose: regarding claim 18, a restriction plate is installed in such a way as to be protruded along the inner peripheral face of the reaction chamber so as to be closely contacted with the upper periphery of the susceptor when it ascends, and the gas exhaust means is installed such that gas in

a space between the inner peripheral face of the upper space of the reaction chamber and the outer periphery of the reaction cell can be pumped through an exhaust port, the reaction chamber being restricted by the ascending susceptor.

Ahn discloses: regarding claim 18, Fig 1, Para 0021, fixture 130, positioned above wafer holder 120 and substrate 200, includes a gas-distribution member 132, a surface-projection (or gas-confinement) member 134, and gas inlets 136 and 137. In the exemplary embodiment, fixture 130 has three operating positions 138A, 138B, and 138C relative support platform 124. Fixture 130 takes operating position 138A, before and after depositions and operating position 138B during depositions. Position 138C is taken during a plasma anneal to ensure stability of the plasma.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a restriction plate, installed in such a way as to be protruded along the inner peripheral face of the reaction chamber so as to be closely contacted with the upper periphery of the susceptor when it ascends, and the gas exhaust means is installed such that gas in a space between the inner peripheral face of the upper space of the reaction chamber and the outer periphery of the reaction cell can be pumped through an exhaust port, the reaction chamber being restricted by the ascending susceptor in the apparatus of Shim, Benko, Shin and Hwang as taught by Ahn.

The motivation for providing a restriction plate, installed in such a way as to be protruded along the inner peripheral face of the reaction chamber so as to be closely contacted with the upper periphery of the susceptor when it ascends, and the gas

exhaust means is installed such that gas in a space between the inner peripheral face of the upper space of the reaction chamber and the outer periphery of the reaction cell can be pumped through an exhaust port, the reaction chamber being restricted by the ascending susceptor is to optimize the apparatus of Shim, Benko, Shin and Hwang to provide a small confine space in their apparatus for carrying out a reaction as taught by Ahn.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171), Hwang et al (US 6,656,284) and Okase (US 5,884,009) as applied to claim 18 above and further in view of Yoder (US 5,281,274).

Shim, Benko, Shin, Hwang and Okase do not disclose: regarding claim 19, a plurality of pumping cell partitioned to no more than the peripheral length of the reaction Cell; and an exhaust pump for pumping gases through an exhaust port connected with the respective pumping cells.

Yoder discloses: regarding claim 19, a first vacuum sub-chamber 28, a second reactant gas sub-chamber 30 or a second vacuum sub-chamber 32. The aforementioned sub-chambers 26, 28, 30 and 32 are integrally affixed to the growth reactor chamber 12 (see FIG. 2).Yoder further discloses (Figs 1, 2), a first high capacity vacuum pump 38 and its associated control valve 40 are both operatively connected to the top of the growth reactor chamber 12 via a pipeline 42. The pipeline 42 connects to the growth reactor chamber 12 via a tailpipe 44. The tailpipe 44 is integrally affixed to

each of the sub-chambers 26, 28, 30 and 32 so as to form a portion thereof. A first plurality of vent holes 46 are configured in the tailpipe 44 so that they exit into the first vacuum sub-chamber 28. Likewise a second plurality of vent holes 48 are configured in the tailpipe 44 so that they exit into the second vacuum sub-chamber 32. These vent holes allow the first high capacity vacuum pump 38 to better maintain the proper operating pressures in the aforementioned vacuum sub-chambers, i.e., at lower operating pressures than the pressures in the reactant gas sub-chambers.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a plurality of pumping cell comprising partition plates; and an exhaust pump for pumping gases through an exhaust port connected with the respective pumping cells in the apparatus of Shim, Benko, Shin, Hwang and Okase as taught by Yoder.

The motivation for providing a plurality of pumping cell comprising baffle plates; and an exhaust pump for pumping gases through an exhaust port connected with the respective pumping cells in the apparatus of Shim, Benko, Shin, Hwang and Okase is to limit cross contamination between the reaction gases in their apparatus as taught by Yoder.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171), Hwang et al (US 6,656,284) and Okase (US 5,884,009) as applied to claim 18 above and further in view of Yudovsky (US 6,821,563).

Shim, Benko, Shin, Hwang and Okase do not disclose: regarding claim 19, a plurality of pumping cell partitioned to no more than the peripheral length of the reaction Cell; and an exhaust pump for pumping gases through an exhaust port connected with the respective pumping cells.

Yudovsky discloses: regarding claim 19, in Figs 1, 2, a vacuum pump (not shown) connected to each reaction cell via holes 155 wherein partition plates 160 is disposed separating the reaction cells (not labeled, regions for precursor A, purge gas, precursor B).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a plurality of pumping cell comprising partition plates; and an exhaust pump for pumping gases through an exhaust port connected with the respective pumping cells in the apparatus of Shim, Benko, Shin, Hwang and Okase as taught by Yudovsky.

The motivation for providing a plurality of pumping cell comprising baffle plates; and an exhaust pump for pumping gases through an exhaust port connected with the respective pumping cells in the apparatus of Shim, Benko, Shin, Hwang and Okase is to limit cross contamination between the reaction gases in their apparatus as taught by Yudovsky.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171), Hwang et al (US 6,656,284) and Ahn

et al (US 2006/0000412) as applied to claim 18 above and further in view of Yoder (US 5,281,274).

Shim, Benko, Shin, Hwang and Ahn do not disclose: regarding claim 19, a plurality of pumping cell partitioned to no more than the peripheral length of the reaction Cell; and an exhaust pump for pumping gases through an exhaust port connected with the respective pumping cells.

Yoder discloses: regarding claim 19, a first vacuum sub-chamber 28, a second reactant gas sub-chamber 30 or a second vacuum sub-chamber 32. The aforementioned sub-chambers 26, 28, 30 and 32 are integrally affixed to the growth reactor chamber 12 (see FIG. 2).Yoder further discloses (Figs 1, 2), a first high capacity vacuum pump 38 and its associated control valve 40 are both operatively connected to the top of the growth reactor chamber 12 via a pipeline 42. The pipeline 42 connects to the growth reactor chamber 12 via a tailpipe 44. The tailpipe 44 is integrally affixed to each of the sub-chambers 26, 28, 30 and 32 so as to form a portion thereof. A first plurality of vent holes 46 are configured in the tailpipe 44 so that they exit into the first vacuum sub-chamber 28. Likewise a second plurality of vent holes 48 are configured in the tailpipe 44 so that they exit into the second vacuum sub-chamber 32. These vent holes allow the first high capacity vacuum pump 38 to better maintain the proper operating pressures in the aforementioned vacuum sub-chambers, i.e., at lower operating pressures than the pressures in the reactant gas sub-chambers.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a plurality of pumping cell comprising partition

plates; and an exhaust pump for pumping gases through an exhaust port connected with the respective pumping cells in the apparatus of Shim, Benko, Shin, Hwang and Ahn as taught by Yoder.

The motivation for providing a plurality of pumping cell comprising baffle plates; and an exhaust pump for pumping gases through an exhaust port connected with the respective pumping cells in the apparatus of Shim, Benko, Shin, Hwang and Ahn is to limit cross contamination between the reaction gases in their apparatus as taught by Yoder.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171), Hwang et al (US 6,656,284) and Ahn et al (US 2006/0000412) as applied to claim 18 above and further in view of Yudovsky (US 6,821,563).

Shim, Benko, Shin, Hwang and Ahn do not disclose: regarding claim 19, a plurality of pumping cell partitioned to no more than the peripheral length of the reaction Cell; and an exhaust pump for pumping gases through an exhaust port connected with the respective pumping cells.

Yudovsky discloses: regarding claim 19, in Figs 1, 2, a vacuum pump (not shown) connected to each reaction cell via holes 155 wherein partition plates 160 is disposed separating the reaction cells (not labeled, regions for precursor A, purge gas, precursor B).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a plurality of pumping cell comprising partition plates; and an exhaust pump for pumping gases through an exhaust port connected with the respective pumping cells in the apparatus of Shim, Benko, Shin, Hwang and Ahn as taught by Yudovsky.

The motivation for providing a plurality of pumping cell comprising baffle plates; and an exhaust pump for pumping gases through an exhaust port connected with the respective pumping cells in the apparatus of Shim, Benko, Shin, Hwang and Ahn is to limit cross contamination between the reaction gases in their apparatus as taught by Yudovsky.

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171), Hwang et al (US 6,656,284), Ahn et al (US 2006/0000412) and Yoder (US 5,281,274) as applied to claim 19 above and further in view of Komino et al (US 6,156,151) and Ishihara et al (US 2005/0167052).

Shim, Benko, Shin, Hwang, Ahn and Yoder do not disclose: regarding claim 20, the pumping cell includes: a primary exhaust passageway formed in a space above the restriction plate; a separation plate having a plurality of through-holes formed above the primary exhaust passageway; and a secondary exhaust passageway formed in a space above the separation plate and connected with the exhaust port.

Komino discloses: an exhaust pump 124 is coupled to an exhaust plate 112 comprising exhaust holes 112a, disposed in parallel with the distribution plate 104.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide an exhaust pump disposed in parallel with the distribution plate above the restriction plate in their apparatus.

The motivation for providing an exhaust pump above the distribution plate above the restriction plate in their apparatus is to provide an alternate and equivalent location of the exhaust pump in their apparatus as taught by Komino.

Shim, Benko, Shin, Hwang, Ahn, Yoder and Komino do not disclose: a separation plate disposed between the primary exhaust plate and the exhaust port.

Ishihara discloses: a separation plate 52 disposed between the primary exhaust plate 51 and the exhaust port 4. A primary exhaust passageway is formed in the space above the restriction plate and a secondary exhaust passageway is formed in the space between the separation plate and the exhaust port.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide an exhaust plate above the restriction plate and provide a separation plate between the primary exhaust plate and the exhaust port in the apparatus of Shim, Benko, Shin, Ahn, Hwang, Yoder and Komino as taught by Ishihara.

The motivation for providing an exhaust plate above the restriction plate and provide a separation plate between the primary exhaust plate and the exhaust port in

the apparatus of Shim, Benko, Shin, Ahn, Hwang, Yoder and Komino is to optimize their apparatus for exhausting gases as taught by Ishihara.

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171), Hwang et al (US 6,656,284), Ahn et al (US 2006/0000412) and Yudovsky (US 6,821,563) as applied to claim 19 above and further in view of Komino et al (US 6,156,151) and Ishihara et al (US 2005/0167052).

Shim, Benko, Shin, Hwang, Ahn and Yudovsky do not disclose: regarding claim 20, the pumping cell includes: a primary exhaust passageway formed in a space above the restriction plate; a separation plate having a plurality of through-holes formed above the primary exhaust passageway; and a secondary exhaust passageway formed in a space above the separation plate and connected with the exhaust port.

Komino discloses: an exhaust pump 124 is coupled to an exhaust plate 112 comprising exhaust holes 112a, disposed in parallel with the distribution plate 104.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide an exhaust pump disposed in parallel with the distribution plate above the restriction plate in their apparatus.

The motivation for providing an exhaust pump above the distribution plate above the restriction plate in their apparatus is to provide an alternate and equivalent location of the exhaust pump in their apparatus as taught by Komino.

Shim, Benko, Shin, Hwang, Ahn, Yudovsky and Komino do not disclose: a separation plate disposed between the primary exhaust plate and the exhaust port.

Ishihara discloses: a separation plate 52 disposed between the primary exhaust plate 51 and the exhaust port 4. A primary exhaust passageway is formed in the space above the restriction plate and a secondary exhaust passageway is formed in the space between the separation plate and the exhaust port.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide an exhaust plate above the restriction plate and provide a separation plate between the primary exhaust plate and the exhaust port in the apparatus of Shim, Benko, Shin, Hwang, Ahn, Yudovsky and Komino as taught by Ishihara.

The motivation for providing an exhaust plate above the restriction plate and provide a separation plate between the primary exhaust plate and the exhaust port in the apparatus of Shim, Benko, Shin, Hwang, Ahn, Yudovsky and Komino is to optimize their apparatus for exhausting gases as taught by Ishihara.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shim et al (KR unexamined publication 10-2003-0086056) in view of Benko et al (US 5,186,756), Shin et al (US 2004/0082171) and Hwang et al (US 6,656,284) as applied to claims 1, 3, 5, 6, 8, 11 - 13, 15 and 21 above and further in view of Merry et al (US 2005/0224181).

Shim was discussed above and discloses: regarding claim 22, a plasma generation system (not shown).

Shim, Benko, Shin and Hwang do not disclose: among the reaction cells, at least one reaction cell, to which a reaction gas is supplied, is further provided with a plasma excitation means for plasma-exciting a reaction gas inside the reaction cell, the plasma excitation means being electrically connected with an external RF power application device at the face thereof corresponding to the upper portion of the substrate.

Merry discloses: regarding claim 22, a processing apparatus comprising a remote plasma generator 388 and an additional RF power source 322 (plasma generating system) connected to a gas distribution assembly (Para 0049, Fig 3) and may excite gases present in the process volume 312 between the substrate support assembly 338 and the distribution plate assembly 318.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to couple an additional RF power source to the gas distribution to the gas distribution assembly of Shim, Benko, Shin and Hwang as taught by Merry.

The motivation for coupling an additional RF power source to the gas distribution to the gas distribution assembly of Shim, Benko, Shin and Hwang is to enhance the efficiency of their gas distribution by plasmarizing the gas in their distribution head as taught by Merry.

Response to Arguments

Applicant's arguments filed 11/2/2010 regarding claims 1 – 3, 5, 6, 8 – 15 and 18 – 22 have been fully considered but are moot in view of new grounds of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SATISH CHANDRA whose telephone number is (571)272-3769. The examiner can normally be reached on 8 a.m. - 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, Primary Examiner, Ram Kackar can be reached on 571-272-1436. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Satish Chandra/
Examiner, Art Unit 1716

/Ram N Kackar/
Primary Examiner, Art Unit 1716